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AUTHOR(S):

Brinckmann-voss, Anita

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THE LIFE-CYCLE OF *EIRENE LACTEA* (MAYER, 1900) AND *HELGICIRRHA SCHULZEI* HARTLAUB, 1909 (PHYLUM CNIDARIA, CLASS HYDROZOA, ORDER LEPTOMEDUSAE, FAMILY EIRENIDAE)

ANITA BRINCKMANN-VOSS

Department of Entomology and Invertebrate Zoology, Royal Ontario Museum;
Department of Zoology, University of Toronto, Canada

With 5 Text-figures

Abstract

Medusae were raised from unidentified polyps from the saltwater tanks of the Royal Ontario Museum. Raised to adult stage the medusae proved to be Leptomedusae, Family Eirenidae, species *Eirene lactea*. The hydroid was not described before.

The medusa *Helgicirrha schulzei* was raised from a hydroid from the Bay of Naples, Italy. The hydroid of *Helgicirrha schulzei* is a hydroid which was previously thought to be the hydroid of *Octorchis gegenbauri* (Leptomedusae, Eutimidae).

Introduction

During the past twenty years quite an improvement towards a unified system of hydroids and medusae within the order Athecatae/Anthomedusae has been made (REES 1957, RUSSELL 1953, 71, EDWARDS 1963–72, BRINCKMANN-VOSS 1970). Within the Thecatae/Leptomedusae, however, our knowledge is confined to isolated species and much work needs to be done towards a unified system. Therefore the life-cycles of two related species of the Leptomedusae may be of some interest.

Acknowledgements

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The life-cycle of *Helgicirrha schulzei* was done at the Naples Zoological Station financed by a grant of the Office of Naval Research, grant No. 2100(00). I wish to thank the director of the Naples Station, Dr. P. DOHRN for all help.

The life-cycle of *Eirene lactea* was done with specimens from the salt-water tanks of the Royal Ontario Museum in Toronto. I thank Dr. COLLINS and Mr. H. SABELIS for letting me use these facilities. Identification of the medusae was made possible through comparative material from the AGASSIZ Museum, Harvard University. I thank Dr. H. LEVI for making this material available to me.

The Life-History of *Eirene lactea*

The origin of the hydroid colony of *Eirene lactea* is not known. However the

material came from the southeastern parts of the U.S.A. This agrees with the distribution of the medusae of *Eirene lactea* as described by MAYER (MAYER 1900). The water-temperature in the tanks of the Museum where the hydroid was found was up to 95 °F in summer and between 70 and 75 °F for the rest of the year. The hydroids were fed with *Artemia* nauplii and multiplied rapidly. Numerous medusae buds were produced by the end of December 1970. Two of the medusae were raised to the adult stage. The young medusae had to be "handfed" under the dissecting microscope with clods of boiled egg yolk and cut up brine-shrimps. After the medusae had reached a diameter of 3 mm brine shrimps were simply added to the sea-water. Both, hydroid and medusae were kept in several month old Instant Ocean.

The hydroid colony consists of unbranched upright hydranths growing from a creeping hydrorhiza which forms an irregular network. The hydrorhiza and the short stems of the hydranths are enclosed by a thin perisarc; it does not taper off towards the naked part of the stem as in *Helgicirrha schulzei* (compare Fig. 1 with Fig. 4). The hydranths are about 2 mm high with a conical proboscis and 10 to 12 tentacles with scattered cnidocysts. The tentacles are connected by a thin membrane

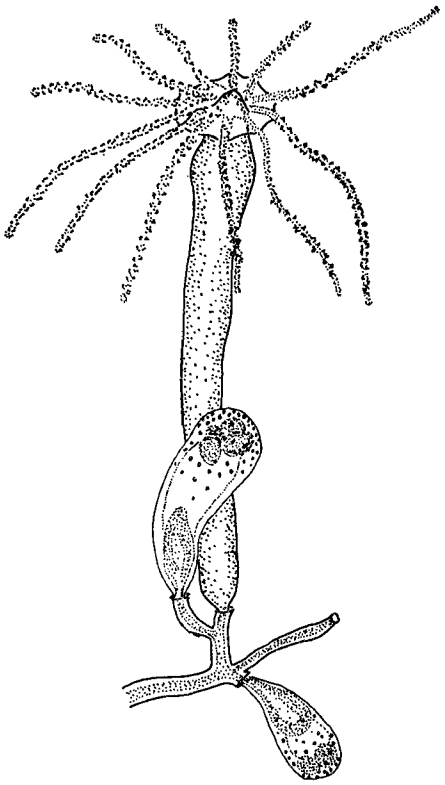

Fig. 1. *Eirene lactea*; hydroid with medusa buds.

at their basal part, known as the "web". The web does not contain giant cnidocyst cells as it is known from *Aequorea forscalea* (Aequoriidae) and *Eucheilota cirrata* (Lovenellidae, BRINCKMANN 1959).

The medusa buds are born on small stalks growing either from the perisarc enclosed short stem of the hydranth or from the hydrorhiza, but always adjacent to the point where the hydranth stem grows. They develop single buds on a short perisarc enclosed stem. The medusa buds themselves are not enclosed by a gonotheca, only by a thin ectodermal sheath. The medusa buds are liberated with four perradial tentacles and 8 statocysts with one concretion in each. (Fig. 2). The stomach measures

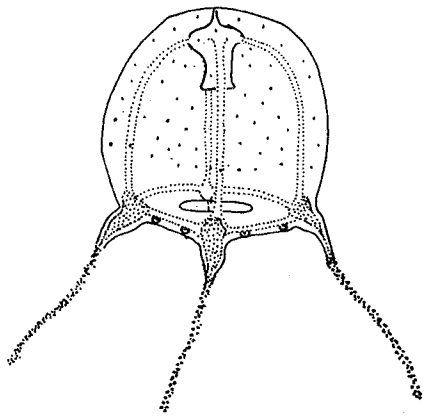

Fig. 2. *Eirene lactea*; medusa one day old.

about 1/3 of the height of the subumbrella. It is provided with four simple perradial lips. There are scattered cnidocysts on the upper two thirds of the exumbrella leaving the basal part of the exumbrella cnidocyst free. These exumbrellar cnidocysts vanish after one week. The further development of the two medusae of *Eirene lactea* is shown in Table 1.

The adult medusa (there were only females) is slightly higher than wide with a peduncle measuring about 2/3 of the lenght of the subumbrella. The stomach is rather small and provided with four perradial slightly crenulated lips. The gonads are on the radial canals but end about 2–4 mm apical to the point where the radial canals enter the ring canal. Between two successive tentacles there are either one or two statocysts so that the total number of statocysts always exceeds the number of tentacles. There are one to three rudimentary tentacle bulbs between successive tentacles (Fig. 3b).

I could not determine for sure if there are excretory pores in this species. But MAYER who described the species (MAYER 1900) did not mention them and KRAMP who apparently reviewed only MAYER's description (KRAMP 1961) puts a question

Table 1. Developmental data of *Eirene lactea* medusae. (Two specimens were liberated the same day and are listed as "A" and "B" here.)

Age in days	Height of exumbrella	Diameter of exumbrella	Tentacles	Tent. bulbs	Statocysts	Manubrium	Gonads
1	A 0.78mm	0.75mm	4 perr.	—	8	short, 4 perr. lips.	—
1	B 0.71mm	0.75mm	"	—	"	"	—
5	A 0.88mm	1.00mm	"	—	"	"	—
5	B 0.71mm	0.88mm	"	—	"	"	—
11	A 1.25mm	1.25mm	"	4 interr.	"	lips enlarging, no peduncle.	—
17	A 1.25mm	1.75mm	"	"	"	"	—
17	B 1.00mm	1.25mm	"	"	"	"	—
23	A 1.64mm	2.25mm	4 perr. 4 interr.	8 adrad.	8	"	—
23	B 1.25mm	1.75mm	4 perr.	4 interr.	8	"	—
26	A 1.80mm	2.50mm	4 perr. 4 interr.	8 adrad.	10	"	—
34	A 3.50mm	4.00mm	4 perr. 4 interr. 8 adrad.	10 adrad.	20	"	—
34	B 3.00mm	3.20mm	4 perr. 4 inter. 4 adrad.	4 adrad.	21	"	—
42	A no measurements taken					short peduncle	appearance of gonads
	B no measurements taken		"	"	"	" "	
49	A 5.00mm	6.00mm	32	12	43	peduncle	gonads with eggs
49	B 4.60mm	5.50mm	24	13	32	"	
96	A 18.00mm	20.00mm	68	1–2 rudiment. bulbs between tentacles	1–2 stat. between tentacles.	"	
96	B 15.00mm	12.00mm	59	"	"	"	

mark after excretory pores for this species.

The identification of this species is based on MAYER's description (MAYER 1900, 1910) of *Phortis* (=*Eirene*) *lactea* and of comparative material of *Eirene lactea* and *Eirene pyramidalis* from the AGASSIZ Museum at Harvard University. KRAMP (1961) united the genera *Eirene* and *Phortis* under the genus *Eirene*.

As MAYER's description of *Eirene lactea* was obviously based on very few specimens and as the species is easily to be mistaken for *Eirene pyramidalis* the specific characters for both species are shown on Table 2.

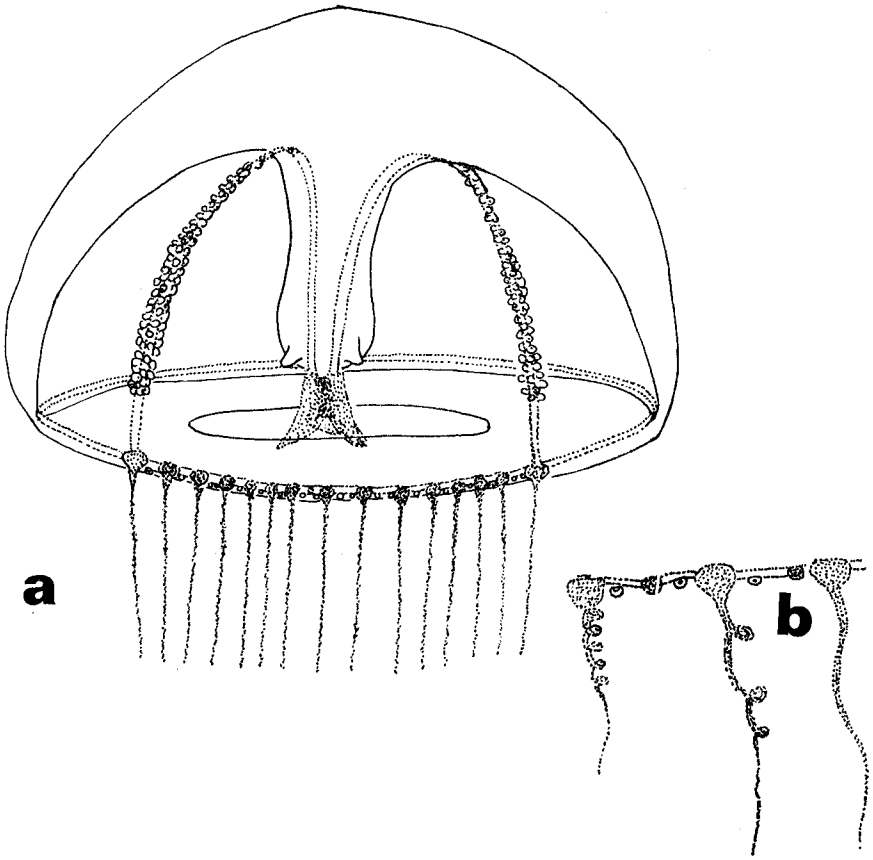

Fig. 3. *Eirene lactea*; a. adult medusa; b. detail of margin.

Table 2. Distinguishing characters between the species *Eirene lactea* and *Eirene pyramidalis*.

		Eirene lactea	*Eirene pyramidalis*
Hydroid		naked hydranths, soft perisarc enclosing only base of hydranth stem and hydrorhiza.	not known.
Medusa	Peduncle	not very broad; filling only about 1/4 of diameter of subumbrellar cavity.	very broad; filling nearly entire subumbrellar cavity.
	Gonads	on radial canals but not extending to ring canal.	on radial canals, extending up to the ring canal.
	Statocysts	exceeding number of tentacles at least by 1/3.	about same number of tentacles.

The Life-History of *Helgicirrha schulzei* HARTLAUB

The hydroid, which proved later to be the hydroid of the medusa *Helgicirrha schulzei* HARTLAUB, was found on mud-surface in the Gulf of Naples (Italy) 30 to 40 m deep. It occurred regularly from October to June with its peak of abundance from March to June. Specimens with medusa buds were found from November to May. The hydroids were caught with a "mud-tangle" (BRINCKMANN-VOSS 1970). Adult medusae of *Helgicirrha schulzei* were found in the surface plankton in the outer parts

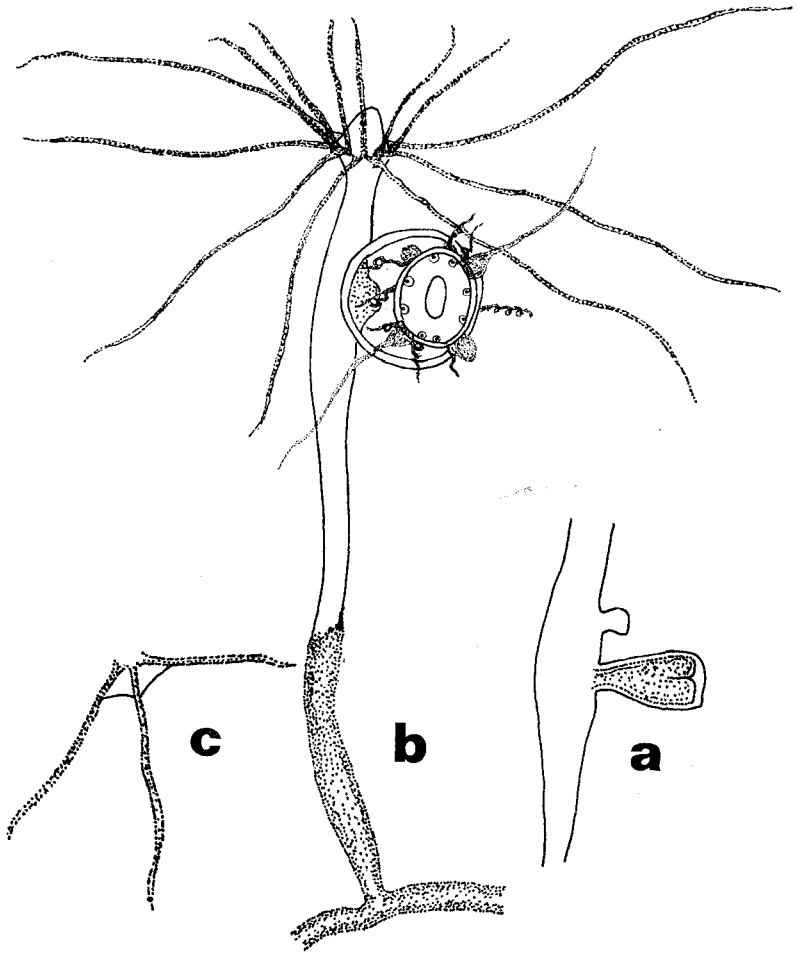

Fig. 4. *Helgicirrha schulzei*; hydroid; a. middle part of hydranth with two young medusa buds. b. hydroid with one medusa bud shortly before liberation. C. tentacles of hydroid showing web between them.

of the Gulf of Naples from April to June. Both hydroids and medusae are easy to keep if fed with brine shrimps and occasionally with hepatopancreas of *Mytilus*.

The hydroid is colonial consisting of unbranched upright hydranths connected by a wide irregular net-like hydrorhiza. Both, the base of the hydranths and the hydrorhiza are enclosed in a soft "sticky" perisarc as we may find it in hydroids of the family Pandeidae.

The living hydranths are slender, 2 mm high with a conical proboscis. There is one circle of 26 to 30 tentacles (Fig. 4). However, every second tentacle is bend more downward than its neighbouring tentacle which gives the impression of two circlets of tentacles (Fig. 4). Medusa buds are born in the middle of the hydranth, sometimes even higher, but never in the perisarc covered basal part or stem of the hydranth. There is usually one bud per hydranth at a time, but sometimes there are two medusa buds in different stages of development on the same hydranth. The medusa buds are naked. The hydroids after being collected from the sea appear to be solitary because one finds always single specimens with some times a small piece of hydrorhiza attached to it. However, if taken into culture a colony is quickly formed and I presume that the hydroid is colonial in the sea, too: as a hydranth gets entangled by the meshes of

Table 3. Developmental data of *Helgicirrha schulzei* medusae.

Age in days	Height of exumbrel.	Diameter of exumb.	Tentacles, tentacle bulbs.	Statocysts	Stomach, gonads, etc.
1	0.7mm	0.9mm	2 perr. tent. with 1 cirr. each; 2 perr. bulbs with two small cirri on each; 2 interr. cirri, 2 interr. bulbs.	8	length of stomach 1/3 of subumbrella.
11	1.5mm	3.0mm	4 perr. tent. with 2 cirri each; 4 interr. bulbs with 2 cirri each; 8 adrad. bulbs without cirri.	8	length of stomach about 1/2 of subumbrella
25	2.0mm	5.0mm	4 perr. tent., 2 with 1 cirrus each; 2 with two cirri; 4 interr. tent. with 2 cir. on each; 15 adrad. bulbs with 1 cir. on each.	17	peduncle developing.
36	3.0mm	7.0mm	4 perr. tent. with 2 cirri on each; 4 interr. tent. with 2 cirri on each; 22 adrad. bulbs with 1 or 2 cirri on each.	18	"
50	3.5mm	9.0mm	4 perr. 4 interr. 8 adrad. tentacles. Between 2 tentacles 1 larger median bulb and 2 adjacent smaller ones.	18	gonads appearing as thickenings of the radial canals.

the net the colony is torn apart and the results are only single specimens.

The newly liberated medusa is 0.6 mm high. The diameter of the exumbrella is 0.9 mm. The exumbrella is provided with irregularly distributed cnidocysts, however the basal 1/3 of the exumbrella is cnidocyst free. There is no peduncle, the stomach measures about 1/3 of the height of the subumbrella. It has a four-cornered mouth with the corners pointing perradially. The margin is provided with two opposite perradial tentacles each with one short lateral cirrus. There are two perradial bulbs without tentacles each with one longer lateral cirrus and one short stump-like cirrus. There are two interradial bulbs with one lateral cirrus each and two small interradial bulbs with no cirrus. There are eight statocysts which are nearer to the perradial tentacle bulbs than to the middle of each marginal quarter. The development of the medusa is shown in Table 3. Specimens of *Helgicirrha schulzei* in different stages of development from the plankton corresponded with those which were reared from the hydroid with regard to size, gonad structure, tentacle number, etc.

The mature medusa (Fig. 5)—that means after having shed eggs or sperms respec-

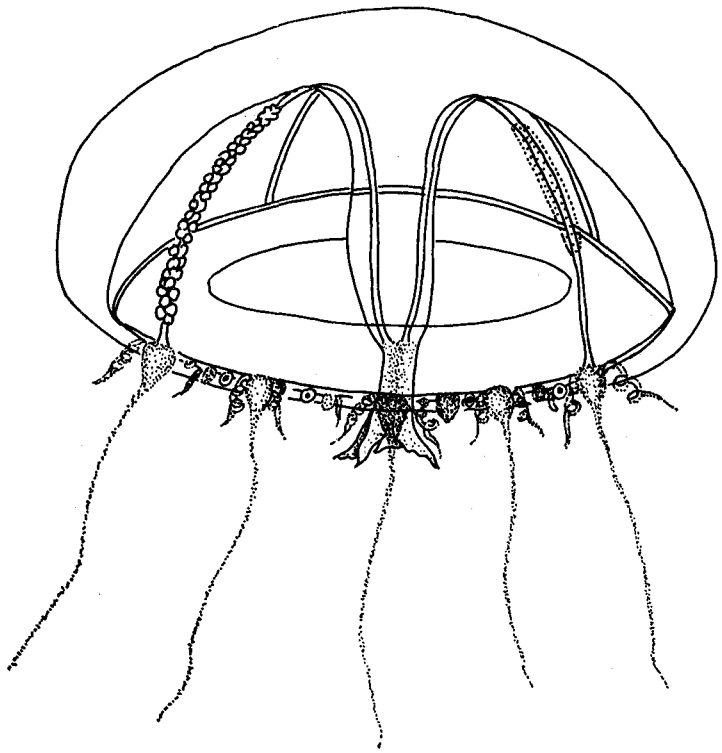

Fig. 5. *Helgicirrha schulzei*; adult medusa; a mature gonad is shown on the left radial canal; a developing gonad is shown on the right radial canal.

tively—has a diameter of 12 to 20 mm and a height of 6 to 8 mm. There are 16 to 28 tentacles with one or two lateral cirri on each. Between two adjacent tentacles there are 1 to 3 tentacle bulbs, the more developed ones carrying 1 lateral cirrus each. KÜNNE (1934) states that the lateral cirri are absent in the largest marginal tentacles. But I found that lateral cirri are present on all tentacles in healthy specimens, only in old and not well fed specimens the lateral cirri are lost very quickly. Therefore, preserved specimens are often without lateral cirri on the perradial and interradial tentacles. RUSSELL (1953) made the same observation about the lateral cirri in *Helgicirrha schulzei.* The peduncle extends to the velum or slightly beyond it. The stomach is short with four perradial lips only slightly crenulated. The gonads occur on that part of the radial canal confined to the disc of the subumbrella. However, the gonads end a short distance before the radial canals enter the ring canal. Excretory pores can clearly be seen on the adaxial side of all larger marginal bulbs.

Taxonomic Discussion

CLAUS (1881) described a hydroid under the name "*Campanopsis*". This hydroid seems to be undistinguishable from the above described hydroid of *Helgicirrha schulzei.* The same is true for the liberated medusa of CLAUS' "*Campanopsis*" except for the fact that exumbrellar cnidocysts in the medusa are arranged like a ring in CLAUS' specimen and occupying the entire upper half of the exumbrella in *Helgicirrha schulzei.* CLAUS did not raise the medusa but compared it with young stages of *Octorchis gegenbauri* from the plankton which are similar to the liberated medusae of his *Campanopsis* hydroid. However, WERNER (in RUSSELL 1971) raised the hydroid of *Octorchis gegenbauri* from the medusa and found that it is not the *Campanopsis* which was described by CLAUS but a Campanuliniid hydroid. Concluding from WERNER's observations and my comparison of *Helgicirrha schulzei* hydroids with CLAUS' "*Campanopsis*" hydroids it seems quite likely that CLAUS had a *Helgicirrha* hydroid when describing his "*Campanopsis*".

The linking of *Eirene lactea* and *Helgicirrha schulzei* medusae to their respective hydroids develops some taxonomic problems because the hydroid stage of both medusae belongs to the Eutimidae and not to the Eirenidae. RUSSELL (1953) separates the Eirenidae from the Eutimidae through the structure of the hydroid which is—where known—provided with a gonotheca and hydrotheca in the Eireniidae and naked—where known—in the Eutimidae. RUSSELL doubts the taxonomic value of the excretory pores, which seems to be justified. However, with the finding that two Eirenid medusae, *Eirene lactea* and *Helgicirrha schulzei,* have so called Eutimid hydroids, the separation of Eirenidae and Eutimidae in the sense of RUSSELL falls down. If one checks the differences between Eirenidae and Eutimidae in KRAMP (1961) which would apply for all species within the two families, there remains only the difference in the hydroid stage. As the Eutimidae and Eirenidae however can not be separated

by their hydroid stage any more because "Eirenid" medusae have "Eutimid" hydroids, I would suggest to unite both families under the family name Eirenidae.

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DISCUSSION

WEILL: In your opinion, do the polyps belong to the gymnoblasts or calyptoblasts?

BRINCKMANN-VOSS: I don't think such a classification to be of a great value.

WEILL: Thank you; that is precisely what I wanted to know.

EDWARDS: I think that in devising a natural classification of hydroids and hydromedusae one must have regard to the whole life history of each species. The hydroid-larval phase is itself specialized for its own mode of life. Where similar medusae are reported to arise from dissimilar hydroids, this may be because the hydroids, though genetically related, have diverged for different larval modes of life. However, if careful examination is made, these apparently similar medusae may be found to be clearly distinguishable.

MILLARD: If there is a life history in which the hydroid obviously belongs to one family and the medusa to another, which family should be used, that of the medusae or that of the hydroid ?